September 22, 2022

ABMA Comments to Utah Division of Air Quality (UDAQ) Proposed NOx Emissions R307-315 & R307-316: NOx Emission Limits for Natural Gas-Fired Boilers, Steam Generators, and Process Heaters

The American Boiler Manufacturers Association (ABMA) is a national organization comprised of 51 Active, 61 Associate, and 4 Affiliate Members in the boiler, burner, controls, and safety standards related industries and organizations. ABMA's Mission is to advocate for the safe production and operation of boilers, facilitate advances in energy efficiency, and provide solutions for our member companies.

In reviewing UDAQ's Proposed NOx Emissions Rules during this comment period of the process, we would like to offer the following:

R307-315: Natural Gas Boilers 2.0 - 5.0 MMBtu

Boiler and burner manufacturers offer a wide variety of technologies that can reduce emissions, and have commercially available equipment that will reduce NOx emissions to <9 ppm. While these technologies are commercially available, they are not without tradeoffs. Certainly, cost is one of those factors. There can also be an impact on efficiency, turndown and operating flexibility. It is our hope that these factors are considered when setting new standards.

In general, the predominant technology incorporated today for equipment in this size range to meet the proposed NOx emissions limitation of 9 ppm utilizes premixed combustion, surface burning technology. To achieve such low NOx levels, high excess air levels are required, typically in the range of 65% – 70%. Non-premixed, non-surface burning technology using more conventional NOx reducing technology, such as flue gas recirculation (FGR) and/or air or fuel staging operates in the 15% – 20% excess air range. However, NOx reduction is less drastic, and resulting NOx levels are in the 20 ppm to 30 ppm range.

There is a trade-off in both efficiency and fuel usage (and, CO_2 GHG emissions) between the two technologies. For example, consider a 50 HP boiler high pressure steam and low pressure steam or hot water (nominally 2 MM Btu/h fuel input) operating under 4 conditions:

Variable	HP Steam		LP Steam or Hot Water	
Stack Temp, °F	450	450	250	250
Excess Air	15	67	15	67
Combustion Efficiency, %[1]	81.8	78.3	86.3	84.8
CO_2 (Tonnes/yr)[2]	950.3	991.5	899.9	916.5

[1] Not including radiation and convection losses

[2] Metric tons per year operating at 8,760 h/yr and 100% rated capacity

It may be seen in the above chart that for a high pressure steam boiler, better than a 4 percentage point increase in both fuel usage and CO_2 GHG emissions is realized operating with premix surface burning technology versus a more conventional NOx reduction technology that utilizes lower excess air. For a low pressure steam or hot water boiler, the increase in CO_2 emissions and fuel usage is closer to 2 percentage for premix surface burning technology. Additionally, the premix surface combustion heads tend to have a shorter life expectancy than more traditional technologies and materials, as they require more frequent replacement. Furthermore, fuel oil cannot be used as a backup fuel with these types of burners.

Similar results are obtained with higher rated input boilers and burners, and therefore the same concerns arise.

The UDAQ should consider a less drastic NOx emissions rate limitation to allow for more conventional technologies to reduce NOx. NOx limits of 20 ppm to 30 ppm is still a substantial reduction in NOx emissions from uncontrolled NOx boilers and burner. Uncontrolled NOx emissions firing natural gas typically range in the 65 ppm to 140 ppm levels, with 80 ppm to 130 ppm being most representative. Conventional NOx reduction technologies utilizing FGR (internal and external), for example, will bring NOx emissions levels down to <30 ppm. This represents a substantial reduction in NOx from uncontrolled sources, and maintains combustion efficiencies as well as CO_2 driven GHG emissions levels. Other benefits of FGR include the ability to operate at higher turndown rates and it supports NOx reductions with oil firing.

One additional comment which ABMA offers addresses Par. (1) of R307-315-4: Emission Limits and Requirements, namely the term "modification". This term is too general in nature. For example, a burner being modified to change from flame rectification scanning to Ultraviolet (UV) or Infrared (IR) flame scanning is a modification of the burner. Yet, this action results in no impact on the burner emissions. According to the UDAQ Fact Sheet under The Rule, it states: *The rule applies to the installation of new boilers, operation of boilers, and in the instance of replacing burners on existing boilers. No retrofits or replacements would be required for existing boilers outside of the useful life of the existing burners.* It is recommended that UDAQ's proposed rule adheres to what is stated in the Fact Sheet, and that the term "modification" be stricken from the proposed rule. The proposed rule should address burner replacement, not modification.

R307-316: Natural Gas Boilers Above 5.0 MMBtu

ABMA acknowledges that NOx reduction technologies not incorporating premix surface combustion to achieve 9 ppm NOx levels becomes more prevalent above 5.0 MMBtu/h in size. With more conventional technologies using FGR for NOx reduction, excess air levels are lower than with premix surface burning technology thereby yielding higher combustion efficiencies and lower increases in CO_2 emissions.

However, our comments regarding this larger equipment and use of the term “modification” of the burner in the proposed rule are similar to those reference in the 2.0 MMBtu/h to 5.0 MMBtu/h category. This term should be stricken from the proposed rule.

Furthermore, we would recommend that UDAQ take a closer look at NOx level limitation and need versus available technologies. 30 ppm and 20 ppm ppm NOx, non-premix and non-high excess air burner technology is widely available at firing rates beginning at 2.0 MMBtu/h. Above approximately 8.0 MMBtu/h, 9 ppm NOx technology utilizing non-high excess air, non-premix surface burning technology is more readily available.

Best regards,

LEADERSHIP FOR THE BOILER INDUSTRY

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